

Pteridophytes, Gymnosperms, Paleobotany, Anatomy and Embryology

*I - M.Sc(Botany) / I - Semester
Choice Based Credit System(CBCS)*



- By

**Prof. N. Savithamma
Prof. Nagalakshmidamma**
Department of Botany
Sri Venkateswara University

Tirupati-517502, Andhra Pradesh, India.



**Centre for Distance and Online Education
Sri Venkateswara University
Tirupathi, AP -517 502**

Year : 2024

Edition : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by



(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

Unit-I: Pteridophytes

1.1	General Characteristics	1
1.1.1	Classification (Spome)	2
1.1.2	Structure of Psilotum	5
1.1.3	Reproduction of Psilotum	11
1.1.4	Life cycle of Psilotum	17
1.2	Structure of Lycopodium	19
1.2.1	Reproduction of Lycopodium	23
1.2.2	Life cycle of Lycopodium	35
1.3	Structure of Equisetum	35
1.3.1	Reproduction of Equisetum	39
1.3.2	Life cycle of Equisetum	45
1.4	Structure of Marsilea	46
1.4.1	Reproduction of Marsilea	53
1.4.2	Life cycle of Marsilea	63
1.5	Stelar Evolution	64
1.5.1	Homospory	68
1.5.2	Heterospory	68
1.5.3	Seed Habit	71

Unit-II: Gymnosperms

2.1	General Characteristics	74
2.2	Classification (Spome)	76
2.3	Structure of Pinus	78
2.3.1	Reproduction of Pinus	81
2.3.2	Life cycle of Pinus	89
2.4	Structure of Gnetum	90
2.4.1	Reproduction of Gnetum	93
2.4.2	Life cycle of Gnetum	103

Unit-III: Palaeobotany

3.1	Fossil	105
3.2	Fossil types	105
3.3	Fossilization methods	107
3.4	Geological time scale	108
3.5	Carbon dating	111
3.6	A brief study of Rhynia	113
3.7	A brief study of Lepidodendron	116
3.8	Calamites.	120

Unit-IV: Anatomy

4.1	Classification of Tissues	125
4.2	Meristems and their types	131
4.3	Complex tissues	127
4.4	Xylem	124
4.5	Phloem	131
4.6	Stomatal types	133
4.7	Secondary growth	135
4.8	Anomalous secondary growth	138

Unit-V: Embryology

5.1	Development of Anther	142
5.2	Male gametophyte development Microsporogenesis	144
5.3	Development of ovule	146
5.4	Female gametophyte development	147
5.5	Double fertilization	150
5.6	Endosperm types and Development	151
5.7	Embryogeny of Dicot	153
5.8	Embryogeny of Monocot	154

BOT-101: Pteridophytes, Gymnosperms, Paleobotany, Anatomy and Embryology

Course Objectives

1. To create awareness on classification and description of lower plants.
2. To create the knowledge about lower plants and their utilization in different methods.
3. Economic importance of lower plants.
4. To provide basic distribution pattern and structural organization of lower plants.

Unit- I: Pteridophytes

General Characteristics, Classification (Sporne), Structure, Reproduction and Life cycle of the following genera. Psilotum, Lycopodium, Equisetum and Marsilea. Stellar Evolution - Homospory, Heterospory and seed Habit.

Unit- II : Gymnosperms

General Characteristics, Classification (Sporne), Structure; Reproduction and Life Cycle of the following genera. Pinus and Gnetum.

Unit- III : Paleobotany

Fossil, Fossil types and Fossilization methods - Geological time scale, Carbon dating. A Brief study of the following form genera. Rhynia, Lepidodendron and Calamites.

Unit- IV: Anatomy

Classification of Tissues. Meristems and their types. Complex tissues, xylem and phloem. Stomatal types. Secondary growth and Anomalous secondary growth.

Unit- V: Embryology

Development of Anther, Microsporogenesis, Male gametophyte development, Development of ovule. Megasporogenesis, Female gametophyte development (Polygonum type) Double fertilization, Endosperm types and Development. Embryogeny of Dicot and Monocot.

REFERENCES

PTERIDOPIYTES

1. Sporne, K.R (1970): The Morphology of pteridophytes (The Structure of Ferns and Allied Plants) Hutchinson University Library, London
2. Sundara Rajan, S. (1994) : Introduction to Pteridophyta New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi, Bangalore, Bombay, Calcutta, Guwahati, Hyderabad, Lucknow, Madras, Pune, London
3. Vashista, P.C. (1997): Botany for Degree Students- Pteridophyta S. Chand & Co., New Delhi,
4. Rashhed, A. (1999) : An Introduction to Pteridophyta Vikas publishing Co., New Delhi,

GYMNOSPERMS

1. Coulter, J.M.& C.J. Chamberlain (1964): Morphology of Gymnosperms Cental Book Depot, Allahabad
2. Sporne, K.R (1971) : The Morphology of Gymnosperms (The Structure and Evolution of Primitive seed Plants) Hutchinson University Library, London
3. Vashista, P.C. (1996) : Botany for Degree Students-Gymnosperms(2nd Edn.,) S. Chand & Co.,New Delhi,

Course Outcomes

1. Discuss the importance of morphological structure, classification, reproduction and economic importance of Algae. Study and impart knowledge about the general Characteristics, structure, reproduction, life history and economic importance of fungi. Understand the features of Lichens.
2. Know the control measures of plant diseases. Students are able to explain about structure, classification, reproduction, life cycle and economic importance of Bryophytes.
3. Study and impart knowledge about the Structure, reproduction, life cycle, fossil, fossilization and geological time scale.
4. Students able to explain about structure, classification, reproduction, life cycle and economic importance of Gymnosperms.

Plant Taxonomy

I - M.Sc(Botany) / I - Semester

Choice Based Credit System(CBCS)



- By

Prof. N. Savithramma

Prof. Nagalakshmidamma

Department of Botany

Sri Venkateswara University

Tirupati-517502, Andhra Pradesh, India.



Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP -517 502

Year : 2024

Edition : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by



(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

INTRODUCTION

BLOCK I: SCOPE AND APPLICATIONS OF PLANT TAXONOMY

UNIT 1 SCOPE AND APPLICATIONS OF PLANT TAXONOMY 1-17

- 1.0 Introduction
- 1.1 Objectives
- 1.2 History and Development of Plant Taxonomy
- 1.3 Scope and Application
- 1.4 Species Concept
 - 1.4.1 Ecotype
 - 1.4.2 Ecad
- 1.5 Binomial System of Nomenclature
- 1.6 Answers to Check Your Progress Questions
- 1.7 Summary
- 1.8 Key Words
- 1.9 Self Assessment Questions and Exercises
- 1.10 Further Readings

UNIT 2 BIOLOGICAL CLASSIFICATION 18-39

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Biological Classification and History
- 2.3 Systematics
 - 2.3.1 Molecular Systematics
 - 2.3.2 Biological Systematics
 - 2.3.3 Structural Systematics
- 2.4 Answers to Check Your Progress Questions
- 2.5 Summary
- 2.6 Key Words
- 2.7 Self Assessment Questions and Exercises
- 2.8 Further Readings

UNIT 3 PLANT CLASSIFICATION 40-64

- 3.0 Introduction
- 3.1 Objectives
- 3.2 History of Plant Classification in India
 - 3.2.1 Rig Veda Period
 - 3.2.2 The Greek Period
 - 3.2.3 The Roman Period
 - 3.2.4 The Dark Age, Herbals and the Transition Period
 - 3.2.5 Modern Period
- 3.3 Classification of Plants
 - 3.3.1 Bentham and Hooker's System
 - 3.3.2 Engler and Prantl System
 - 3.3.3 Takhtajan and Hutchinson System

- 3.4 Answers to Check Your Progress Questions
- 3.5 Summary
- 3.6 Key Words
- 3.7 Self Assessment Questions and Exercises
- 3.8 Further Readings

BLOCK II: TAXONOMY STRUCTURE

UNIT 4 TAXONOMIC STRUCTURE

65-80

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Taxonomy Structure
 - 4.2.1 Cytotaxonomy (Biosystematics)
 - 4.2.2 Chemotaxonomy (Biochemical Systematics)
 - 4.2.3 Numerical Taxonomy
 - 4.2.4 Cladistics Taxonomy
- 4.3 Modern Approach to Taxonomy
 - 4.3.1 Morphological Approach
 - 4.3.2 Embryological Approach
 - 4.3.3 Ecological Approach
 - 4.3.4 Behavioural Approach
 - 4.3.5 Genetical Approach
 - 4.3.6 Biochemical Approach
 - 4.3.7 Numerical Taxonomy
 - 4.3.8 Differential Systematics
- 4.4 Answers to Check Your Progress Questions
- 4.5 Summary
- 4.6 Key Words
- 4.7 Self Assessment Questions and Exercises
- 4.8 Further Readings

UNIT 5 BOTANICAL NOMENCLATURE

81-99

- 5.0 Introduction
- 5.1 Objectives
- 5.2 Botanical Nomenclature
 - 5.2.1 Need For Scientific Names
 - 5.2.2 Proposing A New Name Or New Combination
 - 5.2.3 Why Do Scientific Names Get Changed ?
 - 5.2.4 The International Code of Botanical Nomenclature (ICBN)
 - 5.2.5 Principles of International Code of Botanical Nomenclature, (ICBN)
 - 5.2.6 Author Citation
 - 5.2.7 Rejection of Names
- 5.3 Answers to Check Your Progress Questions
- 5.4 Summary
- 5.5 Key Words
- 5.6 Self Assessment Questions and Exercises
- 5.7 Further Readings

UNIT 6 PRINCIPLES OF DRAFT BIOCODE

100-125

- 6.0 Introduction
- 6.1 Objectives

- 6.2 Principle Of Priority
 - 6.2.1 Principles of Priority
 - 6.2.2 Limitations of Principles of Priority:
 - 6.2.3 Limitations of Principles of Priority
- 6.3 Answers to Check Your Progress Questions
- 6.4 Summary
- 6.5 Key Words
- 6.6 Self Assessment Questions and Exercises
- 6.7 Further Readings

BLOCK III: SALIENT FEATURES OF PLANT FAMILIES

UNIT 7 STUDY OF MONOCOTELEDONS 126-142

- 7.0 Introduction
- 7.1 Objectives
- 7.2 Monocotyledons
- 7.3 *Hydrocharitaceae*
- 7.4 *Dioscoreaceae* - Yam Family
- 7.5 Answers to Check Your Progress Questions
- 7.6 Summary
- 7.7 Key Words
- 7.8 Self Assessment Questions and Exercises
- 7.9 Further Readings

UNIT 8 MONOCOTELEDONS: ARECACEAE AND CYPERACEAE 143-157

- 8.0 Introduction
- 8.1 Objectives
- 8.2 Monocotyledons: *Arecaceae*
- 8.3 Monocotyledons: *Cyperaceae*
- 8.4 Answers to Check Your Progress Questions
- 8.5 Summary
- 8.6 Key Words
- 8.7 Self Assessment Questions and Exercises
- 8.8 Further Readings

UNIT 9 MONOCHLAMYDEAE FAMILY : POLYGONACEAE AND AMARANTHACEAE 158-174

- 9.0 Introduction
- 9.1 Objectives
- 9.2 Polygonaceae : Characteristics, Distribution and Types
- 9.3 Amaranthaceae: Characteristics , Distribution and Types
- 9.4 Answers to Check Your Progress Questions
- 9.5 Summary
- 9.6 Key Words
- 9.7 Self Assessment Questions and Exercises
- 9.8 Further Readings

**UNIT 10 MONOCHLAMYDEAE FAMILY: ARISTOLOCHIACEAE AND
LORANTHACEAE**

175-187

- 10.0 Introduction
- 10.1 Objectives
- 10.2 *Aristolochiaceae* : Charactersitics, Distribution and Affinities
- 10.3 *Loranthaceae* : Charactersitics, Distribution and Affinities
- 10.4 Answers to Check Your Progress Questions
- 10.5 Summary
- 10.6 Key Words
- 10.7 Self Assessment Questions and Exercises
- 10.8 Further Readings

BLOCK IV: SALIENT FEATURES OF PLANT FAMILIES

**UNIT 11 GAMOPETALAE FAMILIES: SAPOTACEAE, RUBIACEAE,
ASTERACEAE AND APOCYNACEAE**

188-211

- 11.0 Introduction
- 11.1 Objectives
- 11.2 *Sapotaceae*: Characterstics, Distribution and Economic Importance
- 11.3 *Rubiaceae*: Characterstics, Distribution and Types
- 11.4 *Asteraceae*: Characterstics, Distribution and Types
- 11.5 *Apocynaceae*: Characterstics, Distribution and Types
- 11.6 Answers to Check Your Progress Questions
- 11.7 Summary
- 11.8 Key Words
- 11.9 Self Assessment Questions and Exercises
- 11.10 Further Readings

UNIT 12 GAMOPETALAE FAMILY: CONVULVULACEAE,

BIGNONIACEEAE, SCROPHULARIACEEAE AND VERBENACEAE 212-234

- 12.0 Introduction
- 12.1 Objectives
- 12.2 *Convolvulaceae*
- 12.3 *Bignoniaceae*
- 12.4 *Scrophulariaceae*
- 12.5 *Verbenaceae*
- 12.6 Answers to Check Your Progress Questions
- 12.7 Summary
- 12.8 Key Words
- 12.9 Self Assessment Questions and Exercises
- 12.10 Further Readings

UNIT 13 POLYPETALAE FAMILIY: MAGNOLIACEAE,

MENISPERMACEAE, PAPAVERACEAE AND TILIACEAE

235-251

- 13.0 Introduction
- 13.1 Objectives
- 13.2 *Magnoliaceae*

- 13.3 *Minispermaceae*
- 13.4 *Papaveraceae*
- 13.5 *Polygalaceae*
- 13.6 *Tiliaceae*
- 13.7 Answers to Check Your Progress Questions
- 13.8 Summary
- 13.9 Key Words
- 13.10 Self Assessment Questions and Exercises
- 13.11 Further Readings

**UNIT 14 POLYPETALAE FAMILY: GERAMIACEAE, MIMOSACEAE,
MYRTACEAE, MELIACEAE AND SAPINDACEAE**

252-270

- 14.0 Introduction
- 14.1 Objectives
- 14.2 *Geramiaceae*
- 14.3 *Mimosaceae*
- 14.4 *Mimosoideae*
- 14.5 *Myrtaceae*
- 14.6 *Meliaceae*
- 14.7 *Sapindaceae*
- 14.8 Answers to Check Your Progress Questions
- 14.9 Summary
- 14.10 Key Words
- 14.11 Self Assessment Questions and Exercises
- 14.12 Further Readings

BOT-102: Plant Taxonomy

Course Objectives

1. To create awareness in Classification of Plants and its arrangements.
2. To train the students to naming (create new names) the newly identified plants.
3. Recognize the plants with the scientific names.
4. To develop skills in identifying the plants for research work to other departments.

SCOPE AND APPLICATIONS OF PLANT TAXONOMY

Unit-1: Scope and applications- Species concept, Biotype, Ecad, Ecotype- Binomial System of Nomenclature.

Unit-2: Theories of Biological Classification- Structural, Biological and Molecular systematics.

Unit-3: Historical Background, Plant classification- Plant classification systems: Bentham and Hooker, Engler and Prantl, Takhtajan and Hutchinson.

TAXONOMIC STRUCTURE

Unit-4: Taxonomic structure: Biosystematics, Chemotaxonomy, Numerical taxonomy-Modern inter-disciplinary approaches to Taxonomy.

Unit-5: Botanical Nomenclature- Need for scientific names- Principles of ICBN. Type method, author citation, Publication of names, rejection of names.

Unit-6: Principle of priority, limitations, conservation of names of species- Draft Biocode.

SALIENT FEATURES OF PLANT FAMILIES

Unit-7: Study of the Monocotyledons: Hydrocharitaceae and Dioscoreaceae

Unit-8: Study of the Monocotyledons: Areaceae and Cyperaceae.

Unit-9: Study of the Monochlamydeae families: Polygonaceae and Amaranthaceae.

Unit-10: Study of the Monochlamydeae families: Aristolochiaceae and Loranthaceae.

SALIENT FEATURES OF PLANT FAMILIES

Unit-11: Study of the Gamopetalae families: Sapotaceae, Rubiaceae, Asteraceae, Apocynaceae.

Unit-12: Study of the Gamopetalae families: Convolvulaceae, Bignoniaceae, Scrophulariaceae and Verbenaceae.

Unit-13: Study of the Polypetalae families: Magnoliaceae, Menispermaceae, Papaveraceae, Polygalaceae and Tiliaceae.

Unit-14: Study of the Polypetalae families: Geraniaceae, Mimosaceae, Myrtaceae, Meliaceae and Sapindaceae.

Course Outcomes:

Course Outcomes:

1. Classify the plants based on the Morphological variation for experimental work.
2. Every student able to create new name to the innovative plant species as per the rules formulated by ICN.
3. Student can help to other Scientists for identification of plants for their research fields.
4. He can learn the preparation of Herbaria for identification purpose.

Suggested Books:

1. Battacharya, B and Johri, B. M. 1998. Flowering Plant taxonomy and Phylogeny. Narosa Publishing House, New Delhi.
2. Cronquist, A. 1981. An integrated system of classification of Flowering Plants. Columbia University Press, New York.
3. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy, Oliver and Boyed.
4. Gifford, E.M. and Foster, A.S. 1998. Morphology and Evolution of Vascular Plants. W.H. freemen & Co., New York.
5. Singh, Gurucharan. 2012. Plant Systematics: Theory and Pactice. Oxford & IBH. New Delhi.
6. Heywood, V.H. and Moore, D.M. (Eds.).1984. Current Concepts in Plant taxonomy. Acad. Press, London.
7. Hutchinson, J. 1973. Families of Flowering Plants (3rd Ed.) oxford Univ. Press, New York.
8. Jeffrey, E. 1982. An introduction to plant Taxonomy. Cambridge.
9. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant systematics (2nd Ed.). Mc Graw Hill. Book Co., New York.
10. Mayr, E. 1942. Systematic and Origin of Species. Columbia Univ. Press, New York.
11. Pullaiah, T. 1997. Taxonomy of Angiosperms. Regency Publications, New Delhi.
12. Radford, A.E. 1986. Fundamentals of Plant Taxonomy. W. H. Freeman and Company, San Francisco.
13. Stebbins, G. L. 1974. Flowering plants Evolution above the Species level. Academic Press London.
14. APG III (2009) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. Bot. J. Linnaean Soc. 161: 105-121.

MICROBIOLOGY

***I - M.Sc(Botany) / I - Semester
Choice Based Credit System(CBCS)***



- By

**Prof. N. Savithamma
Prof. Nagalakshmidamma**
Department of Botany
Sri Venkateswara University

Tirupati-517502, Andhra Pradesh, India.



**Centre for Distance and Online Education
Sri Venkateswara University
Tirupathi, AP -517 502**

Year : 2024

Edition : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by



(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

INTRODUCTION

BLOCK I: HISTORY AND CLASSIFICATION OF MICROORGANISMS

UNIT 1 MICROBIOLOGY: AN INTRODUCTION

1-21

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Introduction to Microbiology
 - 1.2.1 Different Elements
- 1.3 Haeckel's Three-kingdom Concept
- 1.4 Whittaker's Five Kingdom Concept
- 1.5 Three-domain Concept of Carl Woese
- 1.6 Answers to Check Your Progress Questions
- 1.7 Summary
- 1.8 Key Words
- 1.9 Self Assessment Questions and Exercises
- 1.10 Further Readings

UNIT 2 BERGEY'S MANUAL

22-74

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Classification of Bacteria According to Bergey's Manual
 - 2.2.1 Classification of Bacteria
 - 2.2.2 The Proteobacteria
- 2.3 Bergey's Classification of Determinative Bacteriology
 - 2.3.1 The Salient Features of Various Bacteria According to *Bergey's Manual of Determinative Bacteriology*
 - 2.3.2 Gram-Negative Aerobic Rods and Cocci
 - 2.3.3 Facultatively Anaerobic Gram-Negative Rods
 - 2.3.4 Gram-Positive Cocci
 - 2.3.5 Class II Thallobacteria
- 2.4 Answers to Check Your Progress Questions
- 2.5 Summary
- 2.6 Key Words
- 2.7 Self Assessment Questions and Exercises
- 2.8 Further Readings

UNIT 3 FUNGI AND ITS CHARACTERISTICS

75-100

- 3.0 Introduction
- 3.1 Objectives

- 3.2 Classification of Fungi based on Alexopoulous System
 - 3.2.1 Classification of Fungi
 - 3.2.2 Structure of Fungi
 - 3.2.3 Reproduction in Fungi
- 3.3 Characteristics of Fungi
 - 3.3.1 Habitat
 - 3.3.2 Nutrition
 - 3.3.3 Structure
- 3.4 Industrial Uses of Yeasts and Molds
 - 3.4.1 Yeasts
 - 3.4.2 Molds
- 3.5 Answers to Check Your Progress Questions
- 3.6 Summary
- 3.7 Key Words
- 3.8 Self Assessment Questions and Exercises
- 3.9 Further Readings

BLOCK II: MICROSCOPY, STAINING TECHNIQUES, GROWTH AND PRESERVATION METHODS

UNIT 4 MICROSCOPY

101-139

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Simple Microscope
 - 4.2.1 Components of a Microscope
 - 4.2.2 Microscope: Setting Up and Cleaning
- 4.3 Compound
 - 4.3.1 Optical System of a Compound Microscope
 - 4.3.2 Types of Objectives and Eyepieces
 - 4.3.3 Using a Light Microscope
 - 4.3.4 Common Problems in Microscopy
 - 4.3.5 Care and Maintenance
- 4.4 Dark-field
- 4.5 Phase Contrast
- 4.6 Fluorescent
- 4.7 Electron Microscopes
- 4.8 Confocal microscopy: Principles and their Application
 - 4.8.1 Historical Perspective
 - 4.8.2 Principles of Confocal Microscopy
 - 4.8.3 Laser Scanning Confocal Microscope Configuration
 - 4.8.4 Advantages and Disadvantages of Confocal Microscopy
- 4.9 Answers to Check Your Progress Questions
- 4.10 Summary
- 4.11 Key Words
- 4.12 Self Assessment Questions and Exercises
- 4.13 Further Readings

UNIT 5 STAINS AND STAINING TECHNIQUES

140-151

- 5.0 Introduction
- 5.1 Objectives
- 5.2 Introduction to Staining Techniques
- 5.3 Staining and Staining methods
 - 5.3.1 Staining Methods
- 5.4 Answers to Check Your Progress Questions
- 5.5 Summary
- 5.6 Key Words
- 5.7 Self Assessment Questions and Exercises
- 5.8 Further Readings

UNIT 6 GROWTH AND GROWTH CURVE

152-173

- 6.0 Introduction
- 6.1 Objectives
- 6.2 Axenic and Synchronous
 - 6.2.1 Axenic
 - 6.2.2 Synchronous Culture
- 6.3 Aerobic and Anaerobic Culture
- 6.4 Culture Methods and Nutritional Types
- 6.5 Process of Growth of Bacteria
 - 6.5.1 Generation Time of Bacteria
 - 6.5.2 Bacterial Growth Curve
 - 6.5.3 Measurement of Growth
 - 6.5.4 Total and Viable Counts
 - 6.5.5 Factors Affecting Growth
 - 6.5.6 Culture of Bacteria in Laboratory
- 6.6 Answers to Check Your Progress Questions
- 6.7 Summary
- 6.8 Key Words
- 6.9 Self Assessment Questions and Exercises
- 6.10 Further Readings

UNIT 7 PRESERVATION METHODS

174-189

- 7.0 Introduction
- 7.1 Objectives
- 7.2 Preservation Methods: Sterilization and Disinfection
- 7.3 Physical Methods of Sterilization
- 7.4 Chemical Methods of Sterilization
- 7.5 Laboratory Evaluation of Disinfectants
- 7.6 Answers to Check Your Progress Questions

- 7.7 Summary
- 7.8 Key Words
- 7.9 Self Assessment Questions and Exercises
- 7.10 Further Readings

BLOCK III: PROKARYOTIC AND EUKARYOTIC CELL STRUCTURE

UNIT 8 PROKARYOTIC CELL STRUCTURE

190-198

- 8.0 Introduction
- 8.1 Objectives
- 8.2 Microbial Cells: Prokaryotes and Eukaryotes
- 8.3 Structure of a Bacterial Cell
- 8.4 Answers to Check Your Progress Questions
- 8.5 Summary
- 8.6 Key Words
- 8.7 Self Assessment Questions and Exercises
- 8.8 Further Readings

UNIT 9 MICROALGAE AND PROTOZOA

199-238

- 9.0 Introduction
- 9.1 Objectives
- 9.2 General Characters and Classification of Blue Green Algae (Cyanobacteria)
- 9.3 Biological and Economic Importance of Algae
- 9.4 Protozoa: Structural Characteristics, Classification and Reproduction Life Cycle of Plasmodium in Female Anopheles Mosquito
- 9.5 Answers to Check Your Progress Questions
- 9.6 Summary
- 9.7 Key Words
- 9.8 Self Assessment Questions and Exercises
- 9.9 Further Readings

UNIT 10 CELL STRUCTURE AND ORGANIZATION

239-255

- 10.0 Introduction
- 10.1 Objectives
- 10.2 Eukaryotic Cell Structure and its organelles
- 10.3 Lichens structural organisation and their properties
 - 10.3.1 Structure of Lichens
 - 10.3.2 Physiological Characteristics of the Lichen Thallus
 - 10.3.3 Economic Importance of Lichens
- 10.4 Microalgae : Structural organisation and their properties
- 10.5 Answers to Check Your Progress Questions

- 10.6 Summary
- 10.7 Key Words
- 10.8 Self Assessment Questions and Exercises
- 10.9 Further Readings

BLOCK IV: VIROLOGY

UNIT 11 CLASSIFICATION OF VIRUSES

256-264

- 11.0 Introduction
- 11.1 Objectives
- 11.2 Nomenclature and Classification of viruses
- 11.3 Answers to Check Your Progress Questions
- 11.4 Summary
- 11.5 Key Words
- 11.6 Self Assessment Questions and Exercises
- 11.7 Further Readings

UNIT 12 PROPERTIES OF VIRUSES

265-276

- 12.0 Introduction
- 12.1 Objectives
- 12.2 Properties, Morphology and Ultrastructure
 - 12.2.1 Introduction to Virology
 - 12.2.2 Size and Shape of Viruses
 - 12.2.3 General Characteristics of Viruses
- 12.3 Answers to Check Your Progress Questions
- 12.4 Summary
- 12.5 Key Words
- 12.6 Self Assessment Questions and Exercises
- 12.7 Further Readings

UNIT 13 GENOME AND LIFE CYCLE

277-286

- 13.0 Introduction
- 13.1 Objectives
- 13.2 Viral Genome: Their Types and Structures
- 13.3 Life Cycle of Viruses
 - 13.3.1 Lytic Phage
 - 13.3.2 Lysogenic Phage
- 13.4 Answers to Check Your Progress Questions
- 13.5 Summary
- 13.6 Key Words
- 13.7 Self Assessment Questions and Exercises
- 13.8 Further Readings

UNIT 14 AGENTS AND VIRUSES

287-302

- 14.0 Introduction
- 14.1 Objectives
- 14.2 Virus Related Agents
- 14.3 Viroids and Prions
- 14.4 Answers to Check Your Progress Questions
- 14.5 Summary
- 14.6 Key Words
- 14.7 Self Assessment Questions and Exercises
- 14.8 Further Readings

BOT-103 : MICROBIOLOGY

Course Objectives

1. To impart the knowledge on basic principles and techniques of microbiology.
2. To provide understanding on antigen-antibody interactions and scope of vaccines.
3. To give an insight on Fungal/Bacterial and Viral diseases to plants.
4. To describe the structure and isolation of different Viruses.

HISTORY AND CLASSIFICATION OF MICROORGANISMS

Unit-1: Introduction to Microbiology, Haeckel's Three-Kingdom Concept, Whittaker's Five-Kingdom Concept, Three-domain Concept of Carl Woese.

Unit-2: Classification of Bacteria According to Bergey's Manual.

Unit-3: Fungi: Classification of Fungi based on Alexopoulos System-Characteristics of Fungi, Industrial Uses of Yeast and Moulds.

MICROSCOPY, STAINING TECHNIQUES, GROWTH AND PRESERVATION METHODS

Unit-4: Simple, Compound, Dark-Field, Phase Contrast, Fluorescent and Electron Microscopes. (SEM & TEM), Confocal Microscopy-Principles and their Applications.

Unit-5: Stains and Staining Techniques: Simple, Differential, Structural Staining Methods and Imaging Techniques.

Unit-6: Auxenic and Synchronous, Aerobic and Anaerobic, Culture Media and Nutritional Types, Growth Curve, Generation Time and Growth Kinetics. Factors Influencing Microbial Growth.

Unit-7: Preservation Methods of Microbes for Storage, Sterilization and Disinfection.

PROKARYOTIC AND EUKARYOTIC CELL STRUCTURE

Unit-8: Prokaryotic Cell Structure & Organization, Cell Membrane, Plasma Membrane, Cytoplasmic Matrix, Inclusion Bodies, Ribosome, Nucleoid, Prokaryotic Cell Wall, Capsule, Slime Layers, S Layers, Pili and Fimbriae, Flagella and Motility. Bacterial Endospores. Archaeal Cell Structures.

Unit-9: General Characters and Classification of Blue Green Algae (Cyanobacteria)
Macroalgae-Biological and Economic Importance of Algae. Protozoa-Structural Characteristics, Classification and Reproduction.

Unit-10: Eukaryotic Cell Structure and Its Organelles. Lichens and Microalgae-Structural Organization and their Properties.

Course Outcomes

1. Develop the skill of isolation and identification of Pathogenic and Non-Pathogenic micro-organisms.
2. To prepare different media for cultivation of industrially important microorganisms.
3. Equip with the methods to control Plant Pathogens.
4. Understands the Ag-Ab mechanism.

Suggested Books

1. Alexopoulos, C.J., Mims, C.W. and Blackwel, M. 1996. Introductory mycology. John Wiley & Sons Inc.
2. Mandahar, C.L. 1978. Introduction to Plant viruses. Chand & Co., Ltd., Delhi.
3. Mehrotra, R.S. and Aneja, K.R. 1998. An introduction to mycology. New Age International Press.
4. Mehrotra, R.S. 1980. Plant Pathology. Tata Mcgraw hill, India.
5. Sharma, P.D. 2000. Plant Pathology. Narosa Publishing House, India.

***PLANT REPRODUCTION, PLANT DEVELOPMENT
AND PLANT TISSUE CULTURE***

***I - M.Sc(Botany) / I - Semester
Choice Based Credit System(CBCS)***

- By

Prof. N. Savithamma

Prof. Nagalakshmidamma

Department of Botany

Sri Venkateswara University

Tirupati-517502, Andhra Pradesh, India.



**Centre for Distance and Online Education
Sri Venkateswara University
Tirupathi, AP -517 502**

Year : 2024

Edtion : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by



(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

**Centre for Distance and Online Education
Sri Venkateswara University**

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

UNIT - I

Page No.

Chapter-1: Microsporangium and Microporogenesis

1.1	Aims and Objectives	3
1.2	Introduction	3
1.3	Microsporangium	4
1.4.	Microsporogenesis	11
1.5	Summary	14
1.6	Model Examination Questions	14

Chapter-2: Male Gemethophyte and Palynology

2.1	Aim and Objectives	15
2.2	Male Gametophyte	15
2.3	Pollen wall	17
2.4	Palynology	21
2.5	Summary	27
2.6	Model Examination Questions	28

Chapter-3: Megasporangium and Megaspороgenesis

3.1	Objectives	29
3.2	Introduction	29
3.3	Types of Ovules	29
3.4	Ovule Initiation	31
3.5	Integuments	31
3.6	Ovule Associated Structures	32
3.7	Megasporogenesis	40
3.8	Summary	41
3.9	Model Examination Questions	41

Chapter-4: Development and Structure of Embryo SAC

4.1	Aims and Objectives	43
4.2	Introduction	43
4.3	Development of Embryo Sac	44
4.4	Ultrastructure of Embryo Sac	52
4.5	Summary	60
4.6	Model Examination Questions	60

Chapter-5: Fertilization

5.1	Aims and Objectives	61
5.2	Introduction	61

5.3	Structure and function of the stigma and style	62
5.4	Pollen germination	63
5.5	In Vitro Pollen Germination Studies	65
5.6	In Vivo Studies	65
5.7	Pollen Tube Entry into the Embryo Sac	67
5.8	Double Fertilization	69
5.9	Summary	71
5.10	Model Examination Questions	71

UNIT - II

Chapter-6: Plant Reproduction

6.1	Aims and Objectives	75
6.2	Introduction	75
6.3	Development of Endosperm	76
6.4	Ruminate endosperm	85
6.5	Aleurone Tissue	86
6.6	Functions of Endosperm	86
6.7	Summary	87
6.8	Model Examination Questions	87

Chapter-7: Embryo

7.1	Aims and Objectives	89
7.2	Introduction	89
7.3	Embryogeny in Dicots	90
7.4	Embryo Development in Monocotyledons	95
7.5	Embryo Development in Paeonia	97
7.6	Reduced and under Developed Embryos	97
7.7	Ultrastructure and Cytochemistry	98
7.8	Suspensor	99
7.9	Summary	101
7.10	Model Examination Questions	101

Chapter-8: Polyembryony

8.1	Aims and Objectives	103
8.2	Introduction	103
8.3	Nucellar Polyembryony	104
8.4	Integumentary Polyembryony	106
8.5	Synergid Polyembryony	106
8.6	Zygotic and Suspensor Polyembryony	106
8.7	Multiple Polyembryony	108

8.8	Twins and Triplets	108
8.9	Causes of Polyembryony	109
8.10	Significance of Polyembryony	110
8.11	Model Examination Questions	110

Chapter-9: Apomixis

9.1	Objectives	111
9.2	Introduction	111
9.3	Development of Embryo Sac in Apomictic Species	112
9.4	Development of Embryo in Apomictic Species	117
9.5	Causes of Apomixes	118
9.6	Genetics of Apomixis	118
9.7	Apomixis and Plant Breeding	119
9.8	Summary	121
9.9	Model Examination Questions	121

UNIT - III

Chapter-10: Plant Development

10.1	Aims and Objectives	125
10.2	Introduction	125
10.3	Xylem	125
10.4	Phloem	131
10.5	Summary	137
10.6	Model Examination Questions	137

Chapter-11: Shoot Apical Meristem Primary and Secondary Structure of Stem

11.1	Aims and Objectives	139
11.2	Introduction	139
11.3	Shoot Apical Meristem	140
11.4	Primary Structure of Stem	146
11.5	Secondary growth in Stems	152
11.6	Vascular Rays	155
11.7	Tyloses	156
11.8	Resin Ducts and Gum ducts	156
11.9	Summary	157
11.10	Model Examination Questions	157

Chapter-12: Root Apical Meristem Primary and Secondary Structure of Root

12.1	Aims and Objectives	159
12.2	Introduction	159
12.3	Root apical meristem	160

12.4	Root Hair biology and Development	165
12.5	Quiescent Centre	166
12.6	Primary Differentiation	167
12.7	Primary Structure	167
12.8	Lateral Roots	168
12.9	Secondary growth in Dicot Roots	175
12.10	Summary	176
12.11	Model Examination Questions	176

Chapter-13: Leaf Development and Structure

13.1	Aims and Objectives	177
13.2	Introduction	177
13.3	Histology of Angiosperm Leaf	178
13.4	Structure of Petiole	182
13.5	Leaf Development	184
13.6	Structure of Modified Leaves	192
13.7	Summary	195
13.8	Model Examination Questions	195

UNIT - IV

Chapter-14: Plant Development

14.1	Aims and Objectives	199
14.2	Introduction	199
14.3	Methods of Abnormal Growth in Dicot stems	200
14.4	Anomalous Secondary growth in Monocot stems	203
14.5	Anomalous Secondary growth in roots	204
14.6	Summary	204
14.7	Model Examination Questions	205

Chapter-15: Laboratory Organization Medium and Sterilisation

15.1	Aims and Objectives	207
15.2	Introduction	207
15.3	Laboratory Organization for Plant Tissue Culture	207
15.4	Tissue Culture Media	212
15.5	Methods of Sterilization	221
15.6	Summary	225
15.7	Model Examination Questions	225

Chapter-16: Cell Culture

16.1	Aims and Objectives	227
16.2	Types of Suspension Culture	227
16.3	Model Examination Questions	230

Chapter-17: Somatic Embryogenesis Synthetic Seeds

17.1	Aims and Objectives	231
17.2	Introduction	231
17.3	Somatic Embryogenesis	232
17.4	Synthetic Seeds	235
17.5	Summary	238
17.6	Model Examination Questions	238

Chapter-18: Micropropagation of Higher Plants

18.1	Aims and Objectives	239
18.2	Introduction	239
18.3	Micropropagation	239
18.4	Summary	245
18.5	Model Examination Questions	246

UNIT - V

Chapter-19: Somaclonal Variations

19.1	Aims and Objectives	249
19.2	Introduction	249
19.3	Origin of Somaclonal Variation	249
19.4	Factors inFLuencing Somaclonal Variation	251
19.5	Significance of Somaclonal Variations	251
19.6	Isolation of Variants	252
19.7	Summary	254
19.8	Model Examination Questions	254

Chapter-20: Haploid Production

20.1	Aims and Objectives	255
20.2	Introduction	255
20.3	Anther Culture	256
20.4	Pollen Culture	258
20.5	Gynogenesis	259
20.6	Bulbosum Technique	261
20.7	Applications of Haploids in Plant Breeding	261
20.8	Summary	262
20.9	Model Examination Questions	262

Chapter-21: Embryo and Endosperm Culture

21.1	Aims and Objectives	263
21.2	Embryo Culture	263
21.3	Endosperm Culture	265

21.4	Summary	267
21.5	Model Examination Questions	267

Chapter-22: Somatic Hybridization

22.1	Aims and Objectives	269
22.2	Introduction	269
22.3	Isolation of Protoplasts	270
22.4	Culture of Protoplasts	275
22.5	Protoplast Fusion and Somatic Hybridization	276
22.6	Selection of Somatic Hybrids	277
22.7	Cybrids	280
22.8	Application of Somatic Hybrids	281
22.9	Summary	284
22.10	Model Examination Questions	284

Chapter-23: Production of Secondary Metabolites Through Tissue Culture

23.1	Aims and Objectives	285
23.2	Introduction	285
23.3	Types of culture	286
23.4	Bioreactors	288
23.5	Improving the Product Quality and Quantity	293
23.6	Commercial Production	297
23.7	Summary	297
23.8	Model Examination Questions	298

Laboratory Manual

299- 374

BOT-104 : PLANT REPRODUCTION, PLANT DEVELOPMENT AND PLANT TISSUE CULTURE

Unit I

PLANT REPRODUCTION

GAMETOPHYTES, PALYNOLOGY AND FERTILIZATION: Development and structure of anther wall, structure and function of anther tapetum; Microsporogenesis. Male gametophyte development. Palynology, NPC system, applied aspects of palynology. Ovule types, aril, arillode, sarcotesta, caruncle, hypostase, epistase, mamelon, Megasporogenesis. Development of Embryo sac. Ultra structure of embryo sac. Fertilization.

Unit II

PLANT REPRODUCTION

Endosperm development, Haustoria. Embryo development, Polyembryony, Types- Nucellar, integumentary, synergid, zygotic suspensor and multiple polyembryony, Twins and triplets, causes of polyembryony. Apomixis- Apospory, Diplospory, Pseudogamy, semigamy parthenogenesis, polyploidy and apomixis, causes of apomixis,

UNIT III

PLANT DEVELOPMENT

Structure of xylem and phloem. Organisation of shoot Apical meristem, theories associated with Shoot Apical Meristem Primary and secondary growth of stem. Root apical Meristem-Theories. Root Development. Root Development and structure of Foliar Leaf. Anomalous secondary growth-Abnormal position and activity of cambium, intraxylary phloem, interxylary work, secondary growth in monocot stem and Dicot root.

Unit IV

PLANT TISSUE CULTURE

Laboratory organization; Media composition. and preparation; Methods of Sterilization, Cell Culture; somatic embryogenesis technique and utility; synthetic seeds Micropropagation of higher plants; Somaclonal Variations.

Unit V

PLANT TISSUE CULTURE

Haploid production Anther Culture, Pollen Culture, Gynogenesis, Application of haploids; Embryo and Endosperm Culture. Protoplast isolation and Culture, protoplast fusion, production of somatic hybrids and cybrids, hybrid selection and regeneration, application and limitations of protoplast research. Production of secondary metabolites through Tissue Culture, suspension Cultures Bioreactors, cell immobilization, hairy root Cultures.

Plant Physiology and Biochemistry

*I - M.Sc(Botany) / II - Semester
Choice Based Credit System(CBCS)*



- By

**Prof. N. Savithramma
Prof. Nagalakshmidamma**
Department of Botany
Sri Venkateswara University

Tirupati-517502, Andhra Pradesh, India.



**Centre for Distance and Online Education
Sri Venkateswara University
Tirupathi, AP -517 502**

Year : 2024

Edition : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by



(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

Centre for Distance and Online Education

Sri Venkateswara University

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

INTRODUCTION

BLOCK 1: PLANT-WATER RELATIONS

UNIT 1 WATER TRANSPORT MECHANISM 1-20

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Water Transport Process
 - 1.2.1 The Physico-Chemical Properties of Water
- 1.3 Diffusion and Osmosis
 - 1.3.1 Diffusion
 - 1.3.2 Osmosis
- 1.4 Water Potential
- 1.5 Chemical Potential
- 1.6 Water Transport Process in Plants
- 1.7 Answers to Check Your Progress Questions
- 1.8 Summary
- 1.9 Key Words
- 1.10 Self Assessment Questions and Exercises
- 1.11 Further Readings

UNIT 2 WATER ABSORPTION MECHANISM 21-38

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Water Absorption Mechanism
 - 2.2.1 Water Absorption from Soil
 - 2.2.2 Mechanism of Water Absorption by Roots
 - 2.2.3 External Factors Affecting Water Absorption in Roots
 - 2.2.4 Pathway of Water Transport Through Roots
 - 2.2.5 Solute Accumulation and Root Pressure Development in the Xylem Contributes to Water Uptake
- 2.3 Structural Features of Xylem Elements Facilitating Water Transport
 - 2.3.1 Water Transport Through Xylem
 - 2.3.2 Plants are Capable of Overcoming Xylem Cavitation and Blockages
 - 2.3.3 The Cohesion-Tension Theory and its Critical Evaluation
 - 2.3.4 The Soil-Plant Atmosphere Continuum Concept
- 2.4 Answers to Check Your Progress Questions
- 2.5 Summary
- 2.6 Key Words
- 2.7 Self Assessment Questions and Exercises
- 2.8 Further Readings

UNIT 3 TRANSPIRATION MECHANISM IN PLANTS **39-57**

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Transpiration in Plants
 - 3.2.1 Mechanism of Stomatal Transpiration
 - 3.2.2 Factors Affecting the Rate of Transpiration
 - 3.2.3 Significance of Transpiration
 - 3.2.4 Antitranspirants
- 3.3 Structure and Functioning of Stomatal Apparatus in Plants
- 3.4 Mechanism of Stomatal Movement in Plants
 - 3.4.1 Role of Biomolecules in Stomatal Movement
- 3.5 Answers to Check Your Progress Questions
- 3.6 Summary
- 3.7 Key Words
- 3.8 Self Assessment Questions and Exercises
- 3.9 Further Readings

BLOCK 2: PHOTOSYNTHESIS

UNIT 4 PHOTOSYNTHESIS BASICS **58-73**

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Ultrastructure of Photosynthetic Apparatus
 - 4.2.1 Wavelength Dependent Activation of Photosynthetic Pigments
- 4.3 Answers to Check Your Progress Questions
- 4.4 Summary
- 4.5 Key Words
- 4.6 Self Assessment Questions and Exercises
- 4.7 Further Readings

UNIT 5 PHOTOCHEMICAL REACTIONS IN PLANTS **74-92**

- 5.0 Introduction
- 5.1 Objectives
- 5.2 Photochemical Reactions
- 5.3 Electron Transport Pathway in Chloroplast
- 5.4 Answers to Check Your Progress Questions
- 5.5 Summary
- 5.6 Key Words
- 5.7 Self Assessment Questions and Exercises
- 5.8 Further Readings

UNIT 6 CARBON CYCLE AND PHOTORESPIRATION 93-113

- 6.0 Introduction
- 6.1 Objectives
- 6.2 Carbon Cycle
 - 6.2.1 Calvin Cycle
- 6.3 Photorespiration in Plants
- 6.4 Crassulacean Acid Metabolism (CAM)
- 6.5 Answers to Check Your Progress Questions
- 6.6 Summary
- 6.7 Key Words
- 6.8 Self Assessment Questions and Exercises
- 6.9 Further Readings

BLOCK 3: RESPIRATION AND FLOW OF ENERGY

UNIT 7 GLYCOLYSIS AND ELECTRON TRANSPORT 114-131

- 7.0 Introduction
- 7.1 Objectives
- 7.2 Glycolysis - Embden-Meyerhof-Parnas (EMP) Pathway
 - 7.2.1 Anaerobic Respiration (Fermentation Pathway)
- 7.3 Mitochondrial Electron Transport Pathway (Terminal Oxidation)
- 7.4 Answers to Check Your Progress Questions
- 7.5 Summary
- 7.6 Key Words
- 7.7 Self Assessment Questions and Exercises
- 7.8 Further Readings

UNIT 8 OXIDATIVE PHOSPHORYLATION 132-149

- 8.0 Introduction
- 8.1 Objectives
- 8.2 Oxidative Phosphorylation
 - 8.2.1 Mechanism of Oxidative Phosphorylation
 - 8.2.2 Mechanism of ATP Synthesis
- 8.3 Pentose Phosphate Pathway (PPP)
- 8.4 Cyanide Resistant Respiratory Pathway
- 8.5 Answers to Check Your Progress Questions
- 8.6 Summary
- 8.7 Key Words
- 8.8 Self Assessment Questions and Exercises
- 8.9 Further Readings

UNIT 9 NUTRIENT UPTAKE AND TRANSPORT MECHANISMS 150-162

- 9.0 Introduction
- 9.1 Objectives
- 9.2 Nutrient Uptake and Transport Mechanisms
- 9.3 Answers to Check Your Progress Questions
- 9.4 Summary
- 9.5 Key Words
- 9.6 Self Assessment Questions and Exercises
- 9.7 Further Readings

UNIT 10 NITROGEN FIXATION AND AMMONIA ASSIMILATION 163-174

- 10.1 Introduction
- 10.2 Objectives
- 10.2 Biological Nitrogen Fixation
 - 10.2.1 Ammonification
- 10.3 Answers to Check Your Progress Questions
- 10.4 Summary
- 10.5 Key Words
- 10.6 Self Assessment Questions and Exercises
- 10.7 Further Readings

BLOCK 4: CHEMISTRY OF BIOMOLECULES

UNIT 11 CARBOHYDRATES: CLASSIFICATION AND STRUCTURE 175-190

- 11.0 Introduction
- 11.1 Objectives
- 11.2 Carbohydrates
- 11.3 Answers to Check Your Progress Questions
- 11.4 Summary
- 11.5 Key Words
- 11.6 Self Assessment Questions and Exercises
- 11.7 Further Readings

UNIT 12 AMINO ACIDS AND PROTEINS 191-209

- 12.0 Introduction
- 12.1 Objectives
- 12.2 Amino Acids and Proteins: Classification and Structure
 - 12.2.1 Structure of Amino acid
 - 12.2.2 Structural Classification of Amino Acids
 - 12.2.3 Buffering Properties and Titration Curve of Amino Acids
 - 12.2.4 Peptide Bond Formation
 - 12.2.5 Chemical Bonds Present in Proteins
 - 12.2.6 Structural Classification of Protein
- 12.3 Answers to Check Your Progress Questions
- 12.4 Summary
- 12.5 Key Words
- 12.6 Self Assessment Questions and Exercises
- 12.7 Further Readings

UNIT 13 ENZYMES 210-227

- 13.0 Introduction
- 13.1 Objectives
- 13.2 Enzymes
- 13.3 Answers to Check Your Progress Questions
- 13.4 Summary
- 13.5 Key Words
- 13.6 Self Assessment Questions and Exercises
- 13.7 Further Readings

UNIT 14 LIPIDS AND NUCLEIC ACID

228-254

- 14.0 Introduction
- 14.1 Objectives
- 14.2 Lipids
 - 14.2.1 Phospholipids
 - 14.2.2 Composition of Nucleic Acids
- 14.3 Answers to Check Your Progress Questions
- 14.4 Summary
- 14.5 Key Words
- 14.6 Self Assessment Questions and Exercises
- 14.7 Further Readings

BOT-201: Plant Physiology and Biochemistry

Course Objectives

1. To study the method of respiration in plants
2. To study HMP pathway in plants
3. To study importance of growth regulators
4. To study the fat metabolism in plants

PLANT-WATER RELATIONS

Unit-1: Water transport process, diffusion, osmosis, water potential, Chemical potential,

Unit-2: Absorption of water, water transport through trachieds and xylem.

Unit-3: Transpiration and its significance, factors affecting transpiration, mechanism of stomatal movement- Water stress on crop production.

PHOTOSYNTHESIS

Unit-4: Ultra structure of photosynthetic apparatus.

Unit-5: Photochemical reaction- electron transport pathway in chloroplast membranes, photophosphorylation.

Unit-6: C4 carbon cycle- Crassulacean acid metabolism Photorespiration.

RESPIRATION AND FLOW OF ENERGY

Unit-7: Glycolysis- TCA Cycle- electron transport in mitochondria.

Unit-8: Oxidative phosphorylation- pentose phosphate pathway cyanide –resistant respiration.

Unit-9: Nutrient uptake and transport mechanism.

Unit-10: Biological nitrogen fixation, Nitrate and ammonia assimilation.

CHEMISTRY OF BIOMOLECULES

Unit-11: Carbohydrates - Classification, Structure of mono, di and polysaccharides, stereoisomers, enantiomers and epimers.

Unit-12: Amino acids and Proteins - Structure, characteristics and classification - amino acid synthesis - peptide bond and polypeptide chain - primary, secondary, tertiary and quaternary structure of proteins.

Unit-13: Enzymes - General aspects (Classification and structure), allosteric mechanism, regulatory and active sites, isoenzymes, enzymatic catalysis - Michaelis-Menton equation and its significance.

Unit-14: Lipids- Classification and structure, biosynthesis of fatty acids, Oxidation of fatty acids - Nucleic acids - Composition of nucleic acids and nucleotide synthesis.

Course Outcomes

1. Explain what a Plant Physiologists does.
2. Describe how cell, tissue and whole-plant structures are related to their function.
3. Describe the physiological processes in plants, with an emphasis on water, energy, and mineral relations in higher plants.
4. Understand the fundamental processes of metabolism in plants and describe how a plant obtains and uses energy. Understanding of the functioning of plants as organisms.

Suggested Books:

1. Buchanan, B.B. Grussem, W. and Jones, RL. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T. Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds.) 1997. Plant Metabolism (2nd Ed.) Longman, Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag. New York, USA.
4. Hooykaas, P.J.J., Hall, M.A. and Libbeng, K.R. (Eds.). 1999 Biochemsitry and Molecular biology of plant Hormones. Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, New York, USA.
6. Lodish, H., Berk, A., Zipursky, SL., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4th Ed.). W.H. Freeman and Company, New York, USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of plant Hormones (2nd Ed.). Springer-Verlag, New York, USA.
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (2 Ed.). Academic Press, San diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th Ed.). Wadsworth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K. Irrgang K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing Houses, New Delhi.
11. Taiz, L. and Zeigler, E. 1998. Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in plants (2nd Ed.). Academic Press, San Diego, USA
13. Westhoff, P. Jeske, H. Jurgens, G. Kloppstech, K. Link, G. 1998. Molecular Plant Development: From Gene to Plant. Oxford University Press, Oxford, UK.

Year : 2024

Edtion : First

All rights reserved (SVU CDOE). No part of this publication which is material protected by this copyright notice may be reproduced or transmitted or utilized or stored in any form or by any means now known or hereinafter invented, electronic, digital or mechanical, including photocopying, scanning, recording or by any information storage or retrieval system, without prior written permission from the Publisher.

Copyright© 2024, SVU CDOE

All Rights Reserved

Printed

by

®

(An ISO 9001 : 2015 Certified Publishers)

326/C, Surneni Nilayam

Near B K Guda Park, S R Nagar

Hyderabad - 500 038 TS

P.No:+91 40 23710657, 238000657, 23810657

Cell:+91 94405 75657, 93925 75657, 93935 75657

Reg. Off.: 5-68, Pedda Gorpadu, Pakala, Tirupathi - 517 112 AP

mail: studentshelpline.in@gmail.com

for

Director

**Centre for Distance and Online Education
Sri Venkateswara University**

Tirupathi, AP -517 502

mail : directorddesvu@gmail.com

Cell: +91 877-2289380

www.svudde.in

CONTENTS

UNIT - I

	Page No.
Chapter-1: Ecology and its Domain	
1.1 Introduction	3
1.2 Ecological Hierarchy	3
1.3 Subdisciplines of Ecology	4
1.4 Ecology an Interdisciplinary Science	5
1.5 Summary	6
1.6 Model Examination Questions	6
1.7 Further Readings	6
Chapter-2: Ecosystem Structure and Functions	
2.1 Introduction	7
2.2 Structure of Ecosystem	7
2.3 Function of Ecosystem	9
2.4 Summary	10
2.5 Model Examination Questions	10
2.6 Further Readings	10
Chapter-3: Plant Life and Climatic Factors	
3.1 Introduction	11
3.2 Solar Radiation	11
3.3 Light Factor	12
3.4 Temperature Factor	13
3.5 Precipitation, Water and Moisture	13
3.6 Relative Humidity	15
3.7 Atmospheric Gases and Air	15
3.8 Wind Factor	16
3.9 Summary	16
3.10 Model Examination Questions	16
3.11 Further Readings	16
Chapter-4: Plant Life Edaphic (Soil) Factor	
4.1 Introduction	17
4.2 Soil Profile	17
4.3 Physical Properties of Soils	19
4.3.1 Soil Texture	19
4.3.2 Soil Structure	20
4.4 Chemical Properties of Soils	21
4.4.1 Organic Matter	21
4.4.2 Soil pH	21

4.4.3 Cation Exchange Capacity	21
4.5 Summary	22
4.6 Model Examination Questions	22
4.7 Further Readings	22
Chapter-5: Energy Flow in Ecosystems	
5.1 Introduction	23
5.2 Energy Transformations in Ecosystems	23
5.3 Productivity	24
5.3.1 Primary Production	24
5.3.2 Secondary Production	25
5.4 Food Chains and Food Webs	26
5.5 Summary	26
5.6 Model Examination Questions	27
5.7 Further Readings	27
Chapter-6: Principles of Biogeo Chemical Cycling and Global Carbon Cycle	
6.1 Introduction	29
6.2 Principles of Biogeochemical Cycling	29
6.3 Global Carbon Cycle	30
6.4 Summary	31
6.5 Model Examination Questions	32
6.6 Further Readings	32
Chapter-7: Major Ecosystems of The World	
7.1 Introduction	33
7.2 Terrestrial Ecosystems	33
7.2.1 Tundra	33
7.2.2 Grasslands	34
7.2.3 Deserts	35
7.2.4 Forests	36
7.3 Aquatic Ecosystems	38
7.3.1 Freshwater Ecosystems	38
7.3.2 Marine Ecosystems	38
7.4 Summary	40
7.5 Model Examination Questions	40
7.6 Further Readings	41

UNIT - II

Chapter-8: Characteristics of Plant Communities

8.1 Introduction	45
8.2 Analytical Characters of Plant Communities	45

8.2.1 Qualitative Characteristics	45
8.2.2 Quantitative Characteristics	48
8.3 Synthetic Characters of Plant Communities	49
8.3.1 Species Dominance	49
8.3.2 Species Diversity	49
8.4 Summary	50
8.5 Model Examination Questions	50
8.6 Further Readings	50
Chapter-9: Community Succession	
9.1 Introduction	51
9.2 Types of Plant Succession	51
9.3 Process of Succession	52
9.4 Ecosystem Attributes in Succession	52
9.5 Summary	53
9.6 Model Examination Questions	53
9.7 Further Readings	54
Chapter-10: Characteristics of Plant Populations	
10.1 Introduction	
10.2 Density and Dispersion	55
10.3 Natality	55
10.4 Mortality and Survival	56
10.5 Age Structure	58
10.6 Biotic Potential	59
10.7 Summary	59
10.8 Model Examination Questions	59
10.9 Further Readings	59
Chapter-11: Population Growth Patterns and Life History Strategies	
11.1 Introduction	61
11.2 Population Growth Patterns	61
11.2.1 Exponential growth	62
11.2.2 Logistic growth	62
11.3 Life History Strategies- r and K Selection	63
11.4 Summary	64
11.5 Model Examination Questions	65
11.6 Further Readings	65
Chapter-12: Species Interactions	
12.1 Introduction	67
12.2 Plant-Plant Interactions (Competition)	68
12.2.1 Types of Competition	68

12.2.2	Competition Exclusion	68
12.2.3	Classic Competition Theory	69
12.2.4	Interference Competition-Allelopathy	69
12.3	Plant-Animal Interactions (Pollination)	70
12.3.1	Types of Pollination	70
12.3.2	Pollination Syndromes	70
12.4	Summary	72
12.5	Model Examination Questions	73
12.6	Further Readings	73

UNIT - III

Chapter-13: Natural Resources and Non-Conventional Energy Resources

13.1	Introduction	77
13.2	Classification of Natural Resources	77
13.2.1	Forest Resources	78
13.2.2	Water Resources	78
13.2.3	Mineral Resources	78
13.2.4	Land Resources	79
13.3	Non-Conventional Energy Resources	79
13.3.1	Solar Energy	79
13.3.2	Wind Energy	81
13.3.3	Geothermal Energy	81
13.3.4	Hydroenergy	81
13.3.5	Wave and Tidal Energy	81
13.3.6	Bioenergy	82
13.4	Summary	83
13.5	Model Examination Questions	83
13.6	Further Readings	83

Chapter-14: Atmospheric Pollution

14.1	Introduction	85
14.2	Nature, Types and Effects of Air Pollutants	85
14.2.1	Primary Pollutants	86
14.2.2	Secondary Pollutants	87
14.3	Sources of Air Pollutants	87
14.4	Effects of Air Pollutants	88
14.5	Control of Air Pollutants	89
14.6	Summary	89
14.7	Model Examination Questions	90
14.8	Further Readings	90

Chapter-15: Global Warming and Ozone Layer Depletion

15.1	Introduction	91
15.2	Green House Effect and Global Warming	91
15.2.1	Causes of Global Warming	92
15.2.2	Green House Gases	92
15.2.3	Impacts of Global Warming	93
15.2.4	Combating Global Warming	94
15.3	Ozone Layer Depletion	94
15.3.1	Formation of Ozone Hole	95
15.3.2	Antarctica Ozone Hole	96
15.3.3	Impacts of Ozone Layer Depletion	96
15.3.4	Control of Ozone Hole	97
15.4	Summary	97
15.5	Model Examination Questions	97
15.6	Further Readings	97

Chapter-16: Water Pollution

16.1	Introduction	99
16.2	Sources of Water Pollution	100
16.2.1	Physical Factors	100
16.2.2	Chemical Substances	100
16.2.3	Pathogens	100
16.2.4	Ground Water Pollution	101
16.2.5	Thermal Pollution	101
16.2.6	Macroscopic Pollution	102
16.3	Control of Water Pollution	102
16.4	Summary	103
16.5	Model Examination Questions	103
16.6	Further Readings	103

Chapter-17: Soil(Land) Pollution

17.1	Introduction	105
17.2	Sources of Soil Pollution	105
17.3	Effects of Soil Pollutants	107
17.4	Control of Soil Pollutants	108
17.5	Summary	108
17.6	Model Examination Questions	109
17.7	Further Readings	109

Chapter-18: Bioremediation

18.1	Introduction	111
18.2	Phytoremediation	111

18.3	Microbial Bioremediation	112
18.4	Advantages of Bioremediation	112
18.5	Disadvantages of Bioremediation	114
18.6	Summary	114
18.7	Model Examination Questions	114
18.8	Further Readings	114

UNIT - IV

Chapter-19: Biodiversity Nature and Value

19.1	Introduction	117
19.2	Nature of Biodiversity	117
19.3	Values of Biodiversity	119
19.4	Summary	120
19.5	Model Examination Questions	121
19.6	Further Readings	121

Chapter-20: Global Biodiversity Hotspots

20.1	Introduction	123
20.2	Global Biodiversity Hot Spots	123
20.3	Biodiversity Hot Spots in India	125
20.4	Summary	126
20.5	Model Examination Questions	127
20.6	Further Readings	127

Chapter-21: Agrodiversity

21.1	Introduction	129
21.2	Centres of Origin of Crop Plants	129
21.3	The Indian Gene Centre	129
21.4	Summary	132
21.5	Model Examination Questions	132
21.6	Further Readings	132

Chapter-22: Threats to Biodiversity

22.1	Introduction	133
22.2	Process of Extinction	133
22.3	Threats to Biodiversity	134
22.4	Summary	135
22.5	Model Examination Questions	135
22.6	Further Readings	135

Chapter-23: IUCN Threat Categories and Threatened Plants of India

23.1	Introduction	137
23.2	IUCN Threat Categories	137

23.3	Threatened Plants of India	139
23.4	Summary	140
23.5	Model Examination Questions	140
23.6	Further Readings	140
Chapter-24: <i>IN SITU</i> Conservation of Biodiversity		
24.1	Introduction	141
24.2	Protected Area Categories	141
24.3	Protected Area Network in India	142
24.4	Biosphere Reserves	142
24.5	National Parks	144
24.6	Wildlife Sanctuaries	145
24.7	Sacred Groves	145
24.8	Summary	145
24.9	Model Examination Questions	146
24.10	Further Readings	146
Chapter-25: <i>EX SITU</i> Conservation of Biodiversity		
25.1	Introduction	147
25.2	Germ Plasm Banks	148
25.2.1	Cryopreservation	148
25.3	Botanical Gardens	149
25.4	Summary	152
25.5	Model Examination Questions	152
25.6	Further Readings	152

UNIT - V

Chapter-26: Remote Sensing Technology and its Applications to plant resources conservation

26.1	Introduction	155
26.2	Principles of Remote Sensing	155
26.3	Types of Remote Sensing	158
26.3.1	Aerial Photography	158
26.3.2	Satellite Remote Sensing	159
26.4	Remote Sensing	160
26.4.1	Applications for Plant Resources Conservation	160
26.5	Summary	162
26.6	Model Examination Questions	163
26.7	Further Readings	163

Chapter-27: Intellectual Property Rights and Patents

27.1	Introduction	165
------	--------------	-----

27.2 Intellectual Property Rights	165
27.3 Patents	166
27.4 Case Studies of Patents in India	167
27.5 Summary	168
27.6 Model Examination Questions	168
27.7 Further Readings	168
Chapter-28: Participatory Rural Appraisals and Biodiversity Registers	
28.1 Introduction	168
28.2 Participatory Rural Appraisals	169
28.3 Biodiversity Registers	172
28.4 Summary	173
28.5 Model Examination Questions	173
28.6 Further Readings	174
Chapter-29: Environmental Impact Assessment	
29.1 Introduction	175
29.2 EIA Process	176
29.3 Environmental Impact Statement	177
29.4 EIA in India and Projects under EIA	178
29.5 Summary	179
29.6 Model Examination Questions	179
29.7 Further Readings	179
Chapter-30: Concept of Sustainable Development	
30.1 Introduction	180
30.2 Principles of Sustainable Development	181
30.3 Sustainable Development in India	183
30.4 Measures for Sustainable Development	184
30.5 Summary	184
30.6 Model Examination Questions	184
30.7 Further Readings	184

Laboratory Manual

UNIT - I

I. Analysis of Environmental Variables

1. Determination of soil texture.
2. Estimation of organic matter in soil samples.
3. Determination of salinity in water samples.
4. Estimation of dissolved oxygen in water samples.

UNIT - II

II. Community Ecology

5. Sampling inventory of plants of the study area.
6. Determination of minimum size of the quadrat to analyze a plant community.
7. Determination of minimum number of quadrates to analyze a plant community.
8. Determination of quantitative characters of species in a plant community.
9. Determination of Importance Value Index of species in a plant community.
10. Determination of Simpson index of a plant community.
11. Determination of Shannon-Weiner index of a plant community.

UNIT - III

III. Study of Endemic and Threatened Plants

12. Study of selected endemic and threatened plant species of Andhra Pradesh.

UNIT - IV

IV. Experiments in Remote Sensing

13. Acquaintance with Remote Sensing Technology.
14. Measurement of scale of aerial photographs.
15. Study of satellite imagery.
16. Working with Global Positioning System.

BOT-202: ECOLOGY AND BIODIVERSITY

UNIT I: ECOSYSTEMS

Ecology and its domain; ecosystem-structure and functions; plant life and climatic factors; edaphic factor-physical and chemical properties of soils; energy flow in ecosystems-productivity; types of food chains; energy flow modeling; principles of biogeochemical cycling, global carbon cycle; major ecosystems of the world-forests, grasslands, deserts, freshwater and marine.

UNIT II: COMMUNITIES AND POPULATIONS

Characteristics of plant communities-analytic and synthetic characters (Raunkiaers life forms, Qualitative and Quantitative characters, Species dominance and species diversity); community succession-process, types and attributes. Characteristics of plant populations-Density and Dispersion, Natality, Mortality and Survival, Age structure and Biotic potential; population growth-exponential and logistic; life history strategies-*r* and *K* selection; species interactions: plant-plant (competition) and plant-animal (ecology of pollination).

UNIT III: NATURAL RESOURCES AND ENVIRONMENTAL POLLUTION

Classification of natural resources; non-conventional energy resources; atmospheric pollution-types and sources; global warming-green house gases, impact on global environment; ozone layer depletion; Water pollution-sources and control; soil pollution-sources and control; concept of bioremediation.

UNIT IV: BIODIVERSITY AND ITS CONSERVATION

Nature of biodiversity; values of biodiversity; global biodiversity hotspots; agro diversity-centers of origin of crop plants; threats to biodiversity and process of extinction; IUCN threat categories and threatened plants of India; *in situ* conservation of biodiversity-biosphere reserves, wildlife sanctuaries, national parks and sacred groves; *ex situ* conservation-botanical gardens and gene banks.

UNIT V: CONCEPTS IN BIODIVERSITY CONSERVATION AND MANAGEMENT

Remote sensing technology and its applications to plant resources conservation; Intellectual Property Rights (IPR) and Patents; Participatory Rural Appraisals and Biodiversity Registers; Environmental Impact Assessment (EIA); Concept of Sustainable Development.